

INTRODUCTION

Drought is one of the serious consequences of climate change (Venton, 2012). It negatively affects the growth and potential yield of many crops (Zhang et al., 2006).

- Alarming negative effects of drought on the production of bread wheat (*Triticum aestivum*, L.), has been observed in recent years.
- Intensity of the effect of drought on wheat yield depends on factors like growth stage, duration, and severity of the stress (Yang et al., 2010).
- Many physio-morphological traits have shown association with drought tolerance, and variation within these traits is key to breeding drought tolerant varieties.

OBJECTIVE

Objective of this study was to evaluate a panel of spring wheat genotypes for morpho-physiological traits associated with drought tolerance.

MATERIALS AND METHODS

We evaluated a diversity panel of 320 spring wheat genotypes, “Nepali Wheat Diversity Panel (NWDP)” for different physio-morphological traits:

- The panel included 167 Nepali landraces, 34 historical varieties from Nepal, 116 high-performing advanced breeding lines from CIMMYT, and three Canadian varieties.
- The experiment was conducted at Elora research station, University of Guelph, Canada; using *alpha*-lattice design with two replications, under rain-fed conditions

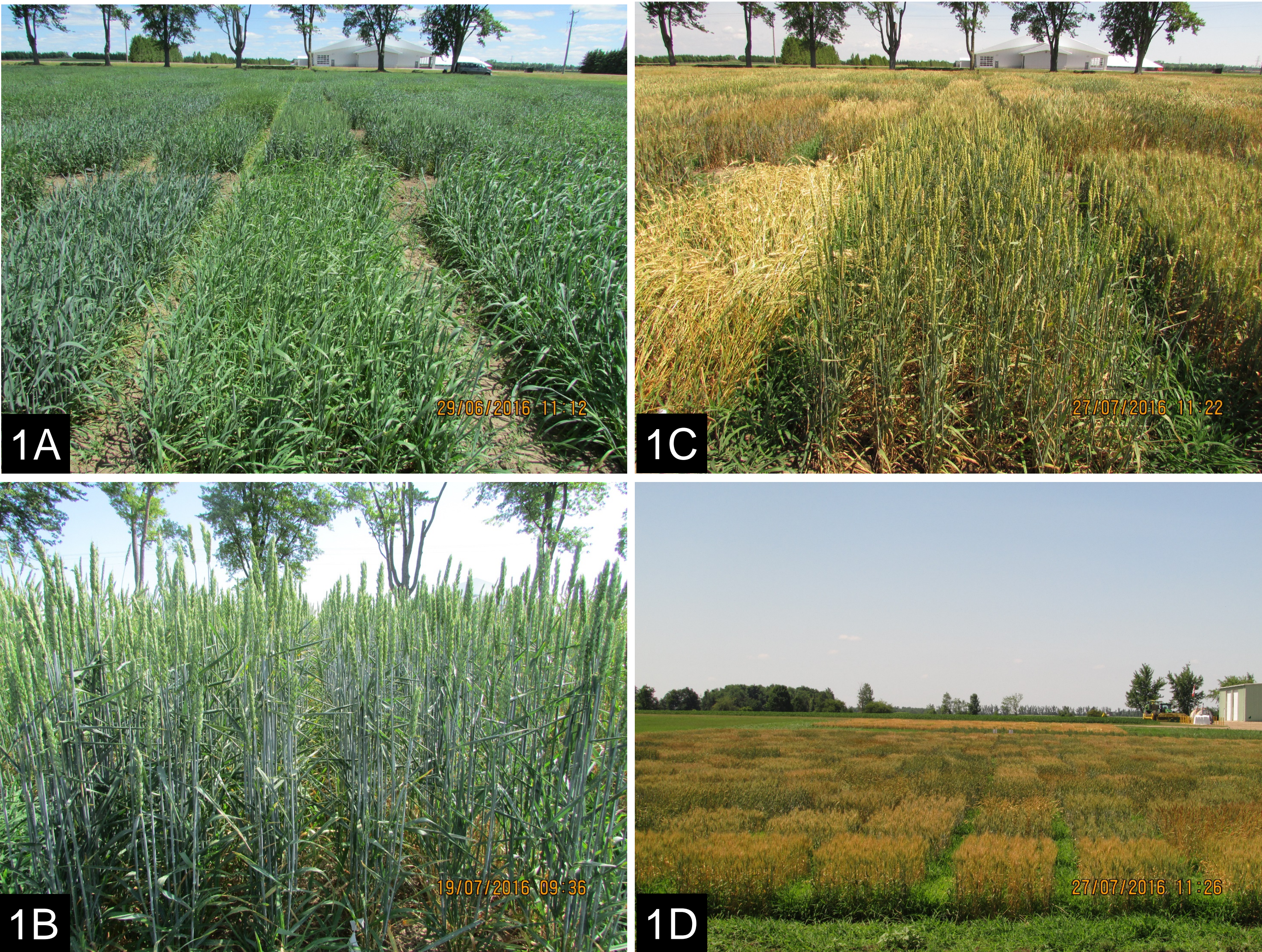


Figure 1A: Variation in leaf/stem waxiness. **Figure 1B:** Waxiness and leaf rolling. **Figure 1C:** Variation in spikes, lodging and plant height. **Figure 1D:** Experimental field indicating diversity visually

RESULTS

We included seven important physio-morphological traits in the evaluation.

- Results showed that genotypes differed significantly for the traits viz. plant height, grain yield and the physiological traits viz. area under NDVI curve (AUNC), area under SPAD curve (AUSC), seedling vigour and waxiness (Table 1)
- No significant difference was observed among the genotypes for test weight.

Table 1. Summary of analysis of variance

Sources of variation	Traits						
	AUNC	AUSC	Plant height	Seedling vigour	Test weight	Waxiness	Grain yield
Block	***	*	***	***	NS	*	***
Iblk(Block)	***	***	***	NS	NS	***	***
Entry	***	***	***	**	NS	***	***

AUNC=Area under NDVI curve, AUSC=Area under SPAD curve. **p* < .05. ***p* < .01. ****p* < .001.

We assessed correlation among the traits considered in the analysis (Table 2).

- The result showed significant positive correlation between waxiness and AUSC.
- Grain yield exhibited significant positive correlation with AUSC, leaf waxiness and seedling vigor.
- Similarly, significant negative correlation was observed between plant height and grain yield.

Table 2. Correlations among different physio-morphological traits under study

Variables	1	2	3	4	5	6	7
1. AUNC	-						
2. AUSC	0.06	-					
3. Test weight	-0.00	-0.07	-				
4. Waxiness	-0.17**	0.65***	-0.06	-			
5. Plant height	0.47***	-0.31***	0.07	-0.48***	-		
6. Seedling vigour	-0.02	0.04	-0.05	0.05	0.14*	-	
7. Yield	-0.22***	0.33***	-0.07	0.33***	-0.38***	0.20**	-

AUNC=Area under NDVI curve, AUSC=Area under SPAD curve. **p* < .05. ***p* < .01. ****p* < .001

We evaluated the association among the seven traits considered in the study using biplot (Figure 2).

- Grain yield has close association with AUSC, waxiness and seedling vigor.
- Plant height and grain yield are negatively associated.
- In the biplot of the PCA analysis of the genotype by trait matrix, majority of the released varieties from Nepal and CIMMYT elite lines clustered towards one side and appear to be high yielding under drought and possess the traits associated with drought tolerance.
- Landraces from Nepal are clustered on the other side. They appear to be taller with lower yield.
- Potential varieties from different groups can be clearly observed in the biplot.

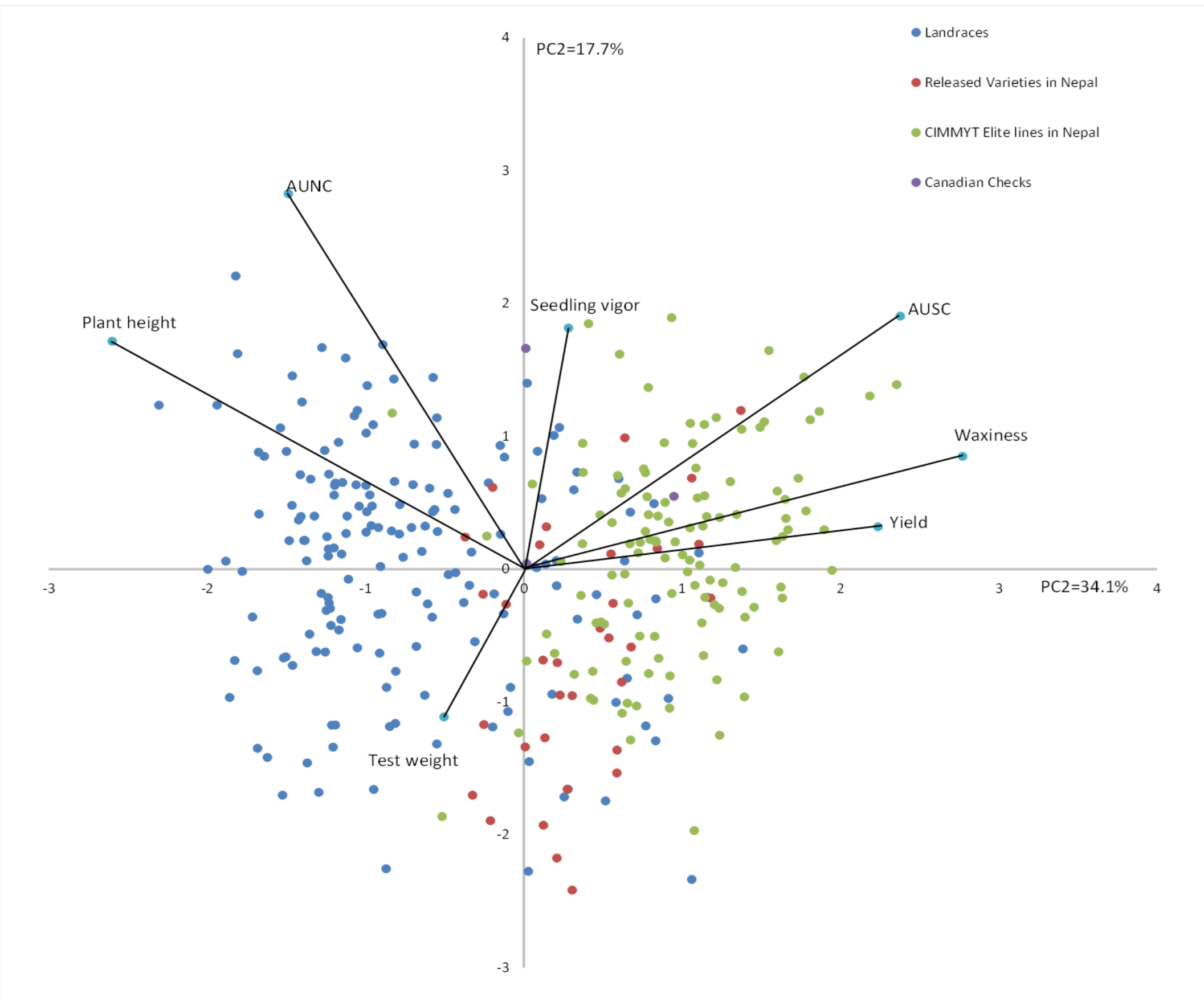


Figure 2: Biplot generated from the principle component analysis of the genotype by trait matrix of the NWDP phenotyped for six different physio-morphological traits.

CONCLUSIONS

Based on the results obtained we concluded:

- There is variation among the genotypes in the diversity panel for different physio-morphological traits.
- Physiological traits like higher chlorophyll content, leaf/stem waxiness, seedling vigor indicate positive association with grain yield.
- The results clearly show the possibility for identification of drought tolerant wheat varieties using physiological approach of breeding.

REFERENCES

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